REMARKS

I. Claim Rejections - 35 USC §112

The Examiner rejected claims 2 and 16 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner argued that the recitation is unclear and confusing. The Examiner asked what is meant by the recitation. The Examiner argued that it is unclear what further limiting structure is being recited with respect to the differing sensing films by the recitation given in claims 2 and 16. Further, the Examiner argued, the recitation appears to be drawn to an implicitly recited function of the differing sensing film. The Examiner argued that the Applicant has not further limited the structure or composition of the sensing film in t he recitation that follows "such that" above. The Examiner argued that the recitation also appears drawn to a method of making the sensing film, which is not afforded patentable weight within device claims. The Examiner asserts that claims 2 and 16 merely recite that the differing sensing film(s) comprises sensing film materials and nothing more.

The Examiner further argued that the beginning of the recitation, i.e. "...said differing sensing film comprises sensing film materials..." should parallel the plural differing sensing films or use language drawn to "each" to clearly state such differing sensing films. The Examiner argued that as currently recited "said differing sensing film" is incorrect as a plurality has been claimed.

The Applicant respectfully disagrees with this assessment and notes that in response to this rejection claims 2 and 16 have been amended to the following:

> The system of claim 1 (15) wherein each differing sensing film coating said each sensing component is selected to respond to a different analyte of said plurality of analytes.

This limitation wherein each sensing film is selected to respond to a different analyte of said plurality of analytes is disclosed in the Applicant's paragraph [0035]. Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §112, second paragraph, rejections of claims 2 and 16 be withdrawn.

II. Claim Rejections - 35 USC §103

Requirements for *Prima Facie* Obviousness

The obligation of the examiner to go forward and produce reasoning and evidence in support of obviousness is clearly defined at M.P.E.P. §2142:

> "The examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. If the examiner does not produce a *prima facie* case, the applicant is under no obligation to submit evidence of nonobviousness."

The U.S. Supreme Court ruling of April 30, 2007 (*KSR Int'l v. Teleflex Inc.*) states:

> "The TSM test captures a helpful insight: A patent composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the prior art. Although common sense directs caution as to a patent application claiming as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the art to combine the elements as the new invention does."
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> "To facilitate review, this analysis should be made explicit."

The U.S. Supreme Court ruling states that it is important to identify a *reason* that would have prompted a person to combine the elements and to make that analysis *explicit*. MPEP §2143 sets out the further basic criteria to establish a *prima facie* case of obviousness:

1. a reasonable expectation of success; and

2. the teaching or suggestion of all the claim limitations by the prior art reference (or references when combined).

It follows that in the absence of such a *prima facie* showing of obviousness by the Examiner (assuming there are no objections or other grounds for rejection) and of a *prima facie* showing by the Examiner of a *reason* to combine the references, an applicant is entitled to grant of a patent. Thus, in order to support an obviousness rejection, the Examiner is obliged to produce evidence compelling a conclusion that the basic criterion has been met.

Martin et al. in view of Frye et al./Neuberger

The Examiner rejected claims 1-7, 9, 15, 16, 19, 21, and 23 under 35 U.S.C. §103(a) as being unpatentable over Martin et al. (U.S. Patent No. 5,235,235), hereinafter referred to as "Martin", in view of Frye et al. (U.S. Patent No. 5,076,094), hereinafter referred to as "Frye", and in view of Neuberger (U.S. Patent No. 5,065,140).

The Examiner argued that Martin discloses multiple-frequency acoustic wave devices for chemical sensing in both gas and liquid phase (citing Martin abstract). The Examiner argued that Martin discloses that acoustic wave devices function as highly sensitive detectors of changes in surface mass, and specific sensors are achieved by securing a film capable of immobilizing a particular species from the environment to the interaction region of the device (citing Martin lines 20-39, col. 1) The Examiner argued that Martin discloses a sensor 1 that includes two or more pairs of interdigital electrodes or transducers (IDTs) 10 having different periodicities. The Examiner argued that Martin discloses that each IDT is comprised of first and second electrodes 10a, 10b, and the IDTs are patterned on a piezoelectric substrate 12. The Examiner argued that Martin discloses that each pair of IDTs may launch and receive various AWs, including surface acoustic wave (SAW), also known as a Rayleigh wave, as well as several acoustic plate modes (APMs). The Examiner argued that Martin discloses that a SAW is typically chosen

for gas-phase and materials-characterization applications, while a shear horizontal APM (SH-APM) is chosen for liquid-phase applications. The Examiner argued that Martin shows in FIGS. 3 and 4 the electronic test and measurement circuitry used to launch, receive, and monitor the propagation characteristics (citing Martin lines 30-67, col. 4, FIGS. 1-4).

The Examiner argued that Martin discloses an electronic apparatus 40 for measuring changes in AW velocity and attenuation at multiple frequencies. The Examiner argued that Martin discloses pairs of output IDTs 10 are connected into a feedback loop of an associated amplifier network 42, each functioning as a separate free-running oscillator circuit. The Examiner argued that Martin further discloses that an associated frequency counter 46, which is under the control of computer 30, detects the frequency of oscillation of each oscillator circuit (citing Martin lines 6-67, col. 6, FIGS. 3 and 4). The Examiner argued that any of the frequency counters 46 communicate with the plurality of oscillators such that all the oscillators and frequency counters are connected within the same circuitry. The Examiner argued that Martin further discloses an example of a fabricated device in which the interdigital transducers were defined using an etching process from Au-on-Cr metallization (citing Martin lines 15-57, col. 5). The Examiner argued that with respect to the various outputs of data recited in the claims that Applicant has not established further structure to the device with respect to outputting the different modes, and thereby the prior art is capable of any such outputs as all of the structure is present in the combination.

The Examiner argued that if the disclosure to specific sensors achieved by securing a film capable of immobilizing a particular species from the environment to the interaction regions 13 as disclosed by Martin is not taken to read as sensing regions with differing sensing films, then the Examiner argued it would have been obvious to modify Martin as taught by Frye.

The Examiner argued that Frye discloses dual-output acoustic wave sensor for molecular identification. The Examiner argued that Frye discloses that acoustic

wave chemical sensors utilize a thin film coating which sorbs or binds the chemical species to be detected and when the sorption/binding is selective for the chemical species of interest, a selective chemical sensor is obtained. The Examiner argued that Frye further discloses that because this selectivity is far from perfect, an array of sensors with different coatings is used (citing Frye lines 33-41, col. 6).

The Examiner argued that it would have been obvious to modify Martin to include differing sensing films such as taught by Frye so as to provide a more selective AW sensor.

The Examiner admitted that Martin and Frye do not disclose a single frequency counter that communicates with the plurality of oscillators. The Examiner admitted that Martin does not disclose that each of the sensing components comprise a quartz crystal.

The Examiner argued that Neuberger discloses a gas detection system in which multiple microbalance detectors 122 comprising quartz crystal oscillators are used and the rate of change of crystal oscillation frequency is monitored by a frequency counter 130 under the control of a processor 112 (citing Neuberger abstract, col. 2 and 3, FIG. 1).

The Examiner argued that it would have been obvious to modify the modified Martin device to use quartz crystal as sensing devices (to which the thin film coating would be applied as taught by Frye) such as taught by Neuberger as quartz crystal is a known alternative sensing component for use in producing oscillation frequencies that may be measured and monitored by a frequency counter for gas-phase detection applications.

The Applicant respectfully disagrees with this assessment and notes that independent claims 1, 15 and 19 have been amended to include the limitation wherein at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes in the chemical species from each sensing component.

This limitation is disclosed in the Applicant's specification in paragraphs [0040] - [0044]. Paragraphs [0042] - [0044] are shown as follows:

> [0042] *Vibrations of acoustic wave devices could be used to break down the bonding (i.e., connections) between the analytes(s) and the sensing materials.* A variety of acoustic modes may propagate in a piezoelectric device, this includes bulk waves and surface waves. For most acoustic wave devices the substrate materials and crystal orientation are usually chosen such that the only one mode that can be excited. However, other modes could be excited. *The vibrational frequencies and amplitudes can be chosen, such that they are most suitable for breaking the bonding between the sensing materials and analyte(s).* (emphasis added)
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> [0043] FIG. 3 illustrates a diagram depicting varying modes 300, which can be utilized for desorption in affinity/adsorption type sensors, in accordance with preferred or alternative embodiments of the present invention. For example, "thickness" is depicted in FIG. 3, including a fundamental 302, 3.sup.rd overtone 304 and 5.sup.th overtone 306. A face shear 304 is also depicted in FIG. 3, along with an extensional 306 and a length-width flexure 308. *FIG. 3 illustrates the fact that many modes of vibrations can exist in an acoustic wave device, and that acoustic wave and/or BAW devices are typically designed such that only one mode of vibration is optimized, while other modes are suppressed. According to the embodiments described herein, such "undesired" mode(s), can be utilized for desorption in affinity/adsorption type sensors.* Such modes can include, for example, flexural plate mode (FPM) (e.g., see length-width flexure 308), shear-horizontal acoustic plate mode (SH-APM) (e.g., see face shear 304), and thickness shear mode (TSM) (e.g., see fundamental 302, 3.sup.rd overtone 304 and 5.sup.th overtone 306). It can be appreciated of course that such modes are only a few of many other types of modes which can be utilized in accordance with preferred or alternative embodiments, and are referred to herein for illustrative purposes only. (emphasis added)
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> [0044] FIG. 4 illustrates a high-level flow chart 400 of operations depicting logical operational steps, which can be implemented in accordance with a preferred embodiment of the present invention. As indicated at block 402, the SAW or BAW sensor device can be exposed to various modal measurements, as described herein. Thereafter, as depicted at block 404, such modal information can be acquired. Next, as illustrated at block 406, the SAW or BAW device can be excited with one or more other modes. *Thereafter, as illustrated at block 408, the measurand(s) can be separated from the sensor surface.* Finally, as depicted at block 410, the sensor is ready for the next test. (emphasis added)

One of the innovative aspects of the present invention is that the acoustic wave sensor utilizes multiple acoustic frequency modes of the SAW sensor to detect analytes in a chemical species and also to desorb the analytes (break the bonding)

from the sensors such that the SAW sensor may be utilized again. This utilization of the additional acoustic modes to break the bonding to the selective film coating of the sensor solves the problem with many acoustic wave sensors; i.e. that the analytes will not readily desorb under ambient temperature conditions. The claimed invention uses acoustic modes normally suppressed in order to vibrate the acoustic sensor and therefore break the bonding between the analytes and the sensing materials. As shown in FIG. 4, the measurands must be separated from the sensor surface so that the sensor is ready for the next test. This is done through the excitation of the SAW with other modes. The measurement of the analytes followed by desorption is controlled through the processor, frequency counters and oscillation circuits to the acoustic sensors as shown in FIG. 1. Martin in view of Frye and further in view of Neuberger does not disclose this limitation wherein at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes.

The Applicant notes that one of the limitations of the independent claims includes the limitation of "wherein said plurality of sensing components is disposed within a *cavity formed from a plurality of walls* of said acoustic wave sensor". The Examiner has not cited that this limitation is disclosed in any of the prior art references and therefore Martin in view of Frye and further in view of Neuberger fails as a prima *facie* obviousness combination as each and every limitation is not disclosed.

Furthermore, the Applicant submits that the Examiner has not provided an explicit rationale as to why it would have been obvious to one of ordinary skill to combine the Martin, Frye and Neuberger references. The U.S. Supreme Court has ruled "that a patent composed of several elements is not proved obvious merely be demonstrating that each of its elements was, independently, known in the prior art" and "that this is so because inventions in most, if not all, instances rely on building blocks long since uncovered, and claimed discoveries almost of necessity will ne combinations of what, in some sense, is already known".

The Applicant notes that the U.S. Supreme Court has stated that the Examiner should provide some *articulated* reasoning with some rationale underpinning to support the legal conclusion of obviousness (KSR opinion, page 14). This articulated reasoning should include a *detailed* explanation of the *effects of demands known to the design community* or *present in the marketplace* and the *background knowledge* possessed by a person having ordinary skill in the art. Anything less than such an *explicit* analysis may not be sufficient to support a *prima facie* case of obviousness (KSR opinion, page 14). The Applicant submits that the Examiner has not provided such an explicit reasoning, as required by the U.S. Supreme Court and therefore has not provided a *prima facie* case of obviousness.

Therefore, Martin in view of Frye and further in view of Neuberger fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claims is not disclosed. Furthermore, the Examiner has not provided an explicit reason why one of ordinary skill in the art would combine the references. Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claims 1-7, 9, 15, 16, 19, 21 and 23 based upon Martin in view of Frye and further in view of Neuberger be withdrawn.

Martin in view of Frye/Neuberger/Desu et al.

The Examiner rejected claim 13 under 35 U.S.C. §103(a) as being unpatentable over Martin in view of Frye and Neuberger as applied to claims 1-7, 9, 15, 16, 9, 21, and 23 and in further view of Desu et al. (U.S. Patent No. 5,527,567), hereinafter referred to as "Desu".

The Examiner admitted that Martin in view of Frye and Neuberger does not specifically disclose that the sensing components comprise electrode materials chosen from among the group comprising at least one of TiN, $CoSi_2$, and WC.

The Examiner argued that Desu discloses high quality layered structure oxide ferroelectric thin films which are useful in the applications of piezoelectric transducers and surface acoustic wave devices (citing Desu lines 33-43, col. 4). The

Examiner argued that Desu discloses that a thin bottom layer electrode is deposited on top of the substrate, and may be a conductive nitride such as TiN (citing Desu lines 1-27, col. 6).

The Examiner argued that it would have been obvious to modify the modified device of Martin to include TiN as the electrode material such as taught by Desu in order to provide a known electrode material, in the form of a conductive nitride, on the surface of a substrate for use in a surface acoustic wave device.

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejections of claims 1-7, 9, 15, 16, 19, 21 and 23 applies equally against the rejection of claim 13 based on Martin in view of Frye and further in view of Neuberger and Desu as claim 13 is a dependent claim.

As submitted above, Martin in view of Frye and Neuberger does not disclose at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes. Desu does not provide this disclosure either and therefore Martin in view of Frye and further in view of Neuberger and Desu fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claim 13 is not disclosed.

Furthermore, as submitted above, the Applicant notes that the Examiner has not provided an explicit rationale as to why it would have been obvious to one of ordinary skill to combine the Martin, Frye, Neuberger and Desu references.

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. rejection of claim 13 based on Martin in view of Frye, Neuberger and Desu be withdrawn.

Martin in view of Frye/Neuberger/Ueda et al.

The Examiner rejected claims 14 and 22 under 35 U.S.C. §103(a) as being unpatentable over Martin in view of Frye and Neuberger as applied to claims 1-7, 9, 15, 16, 19, 21, and 23 and in further view of Ueda et al., (citing U.S. Patent No. 6,037,847), hereinafter referred to as "Ueda".

The Examiner admitted that Martin/Frye/Neuberger does not specifically disclose that the sensing components comprise electrode materials chosen from among NiCr and CuAl.

The Examiner argued that Ueda discloses a surface acoustic wave device in which an interdigital electrode of an AlCu alloy is used with an Y-X cut of a $LiTaO_3$ (citing Ueda abstract; lines 7-17, col. 2).

The Examiner argued that it would have been obvious to modify Martin/Frye/Neuberger to include an AlCu alloy material for the interdigital electrode such as taught by Ueda in order to provide a known electrode material for a SAW device (for both surface and leaky surface acoustic waves).

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejections of claims 1-7, 9, 15, 16, 19, 21 and 23 applies equally against the rejections of dependent claims 14 and 22 based on Martin in view of Frye and further in view of Neuberger and Ueda.

As submitted above, Martin in view of Frye and Neuberger does not disclose at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes. Ueda does not provide this disclosure either and therefore Martin in view of Frye and further in view of Neuberger and Ueda fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claims 14 and 22 is not disclosed.

Furthermore, as submitted above, the Applicant notes that the Examiner has not provided an explicit rationale as to why it would have been obvious to one of ordinary skill to combine the Martin, Frye, Neuberger and Ueda references. The Examiner's reason to combine the references "in order to provide a known electrode material for a SAW device" does not explain why one of ordinary skill in the art at the time of the invention would desire to utilize a known electrode material in the combination of Martin, Frye and Neuberger.

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claims 14 and 22 based on Martin in view of Frye, Neuberger and Ueda be withdrawn.

Martin in view of Frye/Neuberger/Pfeifer et al. (993)

The Examiner rejected claim 18 under 35 U.S.C. §103(a) as being unpatentable over Martin in view of Frye and Neuberger as applied to claims 1-7, 9, 15, 16, 19, 21, and 23 above and in further view of Pfeifer et al. (citing U.S. Patent No. 5,795,993), hereinafter referred to as "Pfeifer '993".

The Examiner admitted that Martin/Frye/Neuberger does not specifically disclose a piezoelectric material among a group comprising at least one of: a-quartz, lithium niobate, lithium tantalite, $Li_2B_4O_7$, $GaPO_4$, langasite, ZnO, and epitaxially grown nitrides including Al, Ga, or In.

The Examiner argued that Pfeifer '993 discloses an acoustic-plate-mode (APM) device, or a thickness-shear-mode (TSM) (also known as quartz crystal microbalance or QCM) device having a sensing region. The Examiner argued that Pfeifer '993 discloses that the sensing region includes a sensing film for sorbing a quantity of the photoresist-stripping agent, thereby altering or shifting a frequency of oscillation of an acoustic wave. The Examiner argued that Pfeifer '993 also discloses that in a preferred embodiment of the invention the acoustic-wave device is a SAW device and the sensing film comprises poly(vinylacetate), poly(N-vinylpyrrolidinone), or poly(vinylphenol) (citing Pfeifer '993 abstract). The Examiner argued that Pfeifer '993 discloses that an acoustic-wave sensor 10 comprises an acoustic-wave device 12 having a sensing region 14 including the photoresist-stripping agent film 16 on the surface for sorbing (citing Pfeifer '993 lines 35-67, col. 3, FIG. 1). The Examiner argued that Pfeifer '993 discloses gas-phase applications utilize a SAW, while other applications FPW, APM, or TSM (QCM) devices. The Examiner argued that Pfeifer '993 also discloses that while only a single acoustic-wave device 12 is shown in FIG. 1, one or more additional acoustic-

wave devices may be used for the acoustic-wave sensor to detect a plurality of different agents, or to provide a reference for accurately determining the frequency shift and to compensate for environmental factors including temperature and humidity (citing Pfeifer '993 lines 1-18, col. 4, FIG. 1). The Examiner argued that Pfeifer '993 discloses that the SAW device has a substrate made of piezoelectric material, such as lithium niobate, crystalline quartz, lithium tantalite, or the like (citing Pfeifer '993 lines 18-24, col. 4).

The Examiner argued that Pfeifer '993 discloses that electrical means 20 are connected to the device for generating an acoustic wave and includes an amplifying means 26 for receiving a detected signal. The Examiner argued that Pfeifer '993 discloses that by locating the acoustic-wave sensor in a feedback loop of the amplifying means, a free-running oscillator is formed with the frequency of oscillation changing slightly with the amount of PSA sorbed on or desorbed from the sensing film. The Examiner argued that Pfeifer '993 further discloses that the frequency detection means 28 is a frequency counter, and may include a reference means (e.g. a second free-running oscillator comprising a second acoustic-wave device connected in a feedback loop of a second free-running oscillator comprising a second acoustic-wave device connected in a feedback loop of second amplifier) (citing Pfeifer '993 lines 20-52, col. 6, FIG. 1). The Examiner argued that Pfeifer '993 further discloses that in another embodiment the electrical means 20 comprises amplifying means 26 connected across each of the acoustic wave and SAW devices, with each SAW device forming a free-running oscillator (citing Pfeifer '993 lines 43-67, col. 7). The Examiner argued that with respect to the various outputs of data recited in the claims, the Examiner asserts that Applicant has not established further structure to the device with respect to outputting the different modes, and thereby the prior art is capable of any such outputs as all of the structure is present in the combination.

The Examiner argued that it would have been obvious to modify Martin/Frye/Neuberger to include lithium niobate, crystalline quartz, or lithium

tantalite as a piezoelectric material such as taught by Pfeifer '993 in order to provide a known piezoelectric material for use in surface acoustic wave sensors.

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejections of claims 1-7, 9, 15, 16, 19, 21 and 23 applies equally against the rejections of dependent claim 18 based on Martin in view of Frye and further in view of Neuberger and Pfeifer'993.

As submitted above, Martin in view of Frye and Neuberger does not disclose at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes. Pfeiffer'993 does not provide this disclosure either and therefore Martin in view of Frye and further in view of Neuberger and Pfeiffer'993 fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claim 18 is not disclosed.

Furthermore, as submitted above, the Applicant notes that the Examiner has not provided an explicit rationale as to why it would have been obvious to one of ordinary skill to combine the Martin, Frye, Neuberger and Pfeiffer'993 references. Why would one of ordinary skill in the art at the time of the invention be motivated to provide a known piezoelectric material for use in surface acoustic wave sensors?

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejection of claim 18 based on Martin in view of Frye and Neuberger and further in view of Pfeiffer '993 be withdrawn.

Pfeifer (944) in view of Frye

The Examiner rejected claims 1-7, 9, 15, 16, 18, 19, 21, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pfeifer et al. (citing U.S. Patent No. 5,571,944), hereinafter referred to as "Pfeifer '944" in view of Frye.

The Examiner argued that Pfeifer '944 discloses an acoustic wave based moisture sensor that includes a detector 110 and reference 120 SAW device that are used as feedback elements in oscillator circuits. The Examiner argued that

Pfeiffer '944 also discloses sensing film 12 and reference film 14, as well as RF amplifiers 115 and 125 connected across respective transducer pairs 114 and 124, and a frequency counter 18 connected to detect the difference frequency between the two oscillator circuits (citing Pfeiffer '944 cols. 3 and 4, FIGS. 1, 6, and 7). The Examiner argued that Pfeifer '944 further discloses that in addition to a SAW device, any acoustic wave device may be used in place of the SAW device, such as shear mode resonators (quartz crystal microbalances), acoustic plate mode devices, and flexural plate wave devices (citing Pfeiffer '944 lines 30-42, col. 7). The Examiner argued that with respect to the various outputs of data recited in the claims, the Examiner asserts that Applicant has not established further structure to the device with respect to outputting the different modes, and thereby the prior art is capable of any such outputs as all of the structure is present in the combination.

The Examiner admitted that Pfeifer '944 does not disclose sensing films on the sensing regions. The Examiner stated that Frye has been discussed above. The Examiner argued that it would have been obvious to modify Pfeifer '044 to include differing sensing films such as taught by Frye so as to provide a more selective AW sensor.

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejections of claims 1-7, 9, 15, 16, 19, 21 and 23 over Martin in view of Frye and Neuberger applies equally against the rejection over Pfeifer'944 in view of Frye. As noted above, the independent claims have been amended to include the limitation wherein at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes.

Pfeifer'944 in view of Frye does not disclose at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes and therefore fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claims is not disclosed.

Furthermore, as submitted above, the Applicant notes that the Examiner has not provided an explicit rationale as to why it would have been obvious to one of ordinary skill to combine the Pfeifer'944 and Frye references. The Examiner's entire rationale is "so as to provide a more selective AW sensor". As submitted above, this limited rationale is not an explicit reasoning as required by the U.S. Supreme Court.

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claims 1-7, 9, 15, 16, 18, 19, 21 and 23 based on Pfeifer'944 in view of Frye be withdrawn.

Pfeifer (993) in view of Frye

The Examiner rejected claims 1-7, 9, 15, 16, 18, 19, 21, and 23 under 35 U.S.C. §103(a) as being unpatentable over Pfeifer'993, in view of Frye.

The Examiner argued that Pfeifer '993 discloses an acoustic-wave sensor. The Examiner argued that Pfeifer '993 discloses that the acoustic-wave sensor comprises an acoustic-wave device such as a SAW device, a flexural-plate-wave (FPW) device, an acoustic-plate-mode (APM) device, or a thickness-shear-mode (TSM) (also known as quartz crystal microbalance or QCM) device having a sensing region. The Examiner argued that Pfeifer '993 discloses that the sensing region includes a sensing film for sorbing a quantity of the photoresist-stripping agent, thereby altering or shifting a frequency of oscillation of an acoustic wave. The Examiner argued that Pfeifer '993 also discloses that in a preferred embodiment of the invention the acoustic-wave device is a SAW device and the sensing film comprises poly(vinylacetate), poly(N-vinylpyrrolidinone), or poly(vinylphenol) (citing Pfeifer '993 abstract). The Examiner argued that Pfeiffer '993 discloses that an acoustic-wave device 12 having a sensing region 14 including the photoresist-stripping agent sensing film 16 on the surface for sorbing (citing Pfeifer '993 lines 35-67, col. 3, FIG. 1).

The Examiner argued that Pfiefer '993 discloses gas-phase applications utilize a SAW, while other applications utilize FPW, APM, or TSM (QCM) devices. The

Examiner argued that Pfeifer '993 also discloses that while only a single acoustic-wave device 12 is shown in FIG. 1, one or more additional acoustic-wave devices may be used for the acoustic-wave sensor to detect a plurality of different agents, or to provide a reference for accurately determining the frequency shift and to compensate for environmental factors including temperature and humidity (citing Pfeifer '993 lines 1-18, col. 4, FIG. 1). The Examiner argued that Pfeifer '993 discloses that electrical means 20 are connected to the device for generating an acoustic wave and includes an amplifying means 26 for receiving a detected signal. The Examiner argued that Pfeifer '993 discloses that by locating the acoustic-wave sensor in a feedback loop of the amplifying means, a free-running oscillator is formed with the frequency of oscillation changing slightly with the amount of PSA sorbed on or desorbed from the sensing film. The Examiner argued that Pfeifer '993 further discloses that the frequency detection means 28 is a frequency counter, and may include a reference means (e.g. a second free-running oscillator comprising a second acoustic-wave device connected in a feedback loop of a second amplifier) (citing Pfeifer '993 lines 20-52, col. 6, FIG. 1). The Examiner argued that Pfeifer '993 further discloses that in another embodiment the electrical means 20 comprises amplifying means 26 connected across each of the acoustic wave and SAW devices, with each SAW device forming a free-running oscillator (citing Pfeifer '993 lines 43-67, col. 7). The Examiner argued that with respect to the various outputs of data recited in the claims, that the Applicant has not established further structure to the device with respect to outputting the different modes, and thereby the prior art is capable of any such outputs as all of the structure is present in the combination.

The Examiner argued that Pfeifer '993 discloses multiple acoustic-wave devices used for the acoustic-wave sensor as well as multiple sensing films, but admitted does not specifically disclose differing sensing films on the sensing regions of the devices.

The Examiner stated that Frye has been discussed above. The Examiner argued that it would have been obvious to modify Pfeifer'993 to include differing sensing films such as taught by Frye so as to provide amore selective AW sensor.

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejections of claims 1-7, 9, 15, 16, 19, 21 and 23 over Martin in view of Frye and Neuberger applies equally against the rejection over Pfeifer'993 in view of Frye. As noted above, the independent claims have been amended to include the limitation wherein at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes.

Pfeifer'993 in view of Frye does not disclose at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes and therefore fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claims is not disclosed.

Furthermore, as submitted above, the Applicant notes that the Examiner has not provided an explicit rationale as to why it would have been obvious to one of ordinary skill to combine the Pfeifer'993 and Frye references. The Examiner's entire rationale is "so as to provide a more selective AW sensor". As submitted above, this limited rationale is not an explicit reasoning as required by the U.S. Supreme Court.

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claims 1-7, 9, 15, 16, 18, 19, 21 and 23 based on Pfeifer'993 in view of Frye be withdrawn.

Pfeifer (944) in view of Frye/Desu

The Examiner rejected claim 13 under 35 U.S.C. §103(a) as being unpatentable over Pfeifer '944 in view of Frye as applied to claims 1-7, 9, 15, 16, 21, and 23 and in further view of Desu.

The Examiner admitted that Pfeifer '944/Frye dose not specifically disclose that the sensing components comprise electrode materials chosen from among the group comprising at least one of TiN, $CoSi_2$, and WC.

The Examiner stated that Desu has been discussed above.

The Examiner argued that it would have been obvious to modify Pfeifer '944/Frye to include TiN as the electrode material such as taught by Desu in order to provide a known electrode material, in the form of a conductive nitride, on the substrate for use in a surface acoustic wave device.

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejections of claims 1-7, 9, 15, 16, 19, 21 and 23 applies equally against the rejection of claim 13 based on Pfeifer'944 in view of Frye and further in view of Desu as claim 13 is a dependent claim.

As submitted above, Martin in view of Frye and Neuberger does not disclose at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes. Pfeifer'944 in view of Frye and further in view of Desu does not provide this disclosure either and therefore fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claim 13 is not disclosed.

Furthermore, as submitted above, the Applicant notes that the Examiner has not provided an explicit rationale as to why it would have been obvious to one of ordinary skill to combine the Pfeifer'944, Frye and Desu references. Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. rejection of claim 13 be withdrawn.

Pfeifer (993) in view of Frye/ Desu

The Examiner rejected claim 13 under 35 U.S.C. §103(a) as being unpatentable over Pfeifer '993 in view of Frye as applied to claims 1-7, 9, 15, 16, 18, 19, 21, and 23 and in further view of Desu.

The Examiner admitted that Pfeifer '993/Frye does not specifically disclose that he sensing components comprise electrode materials chosen from among the group comprising at least one of TiN, $CoSi_2$, and WC.

The Examiner stated that Desu has been discussed above. The Examiner argued that it would have been obvious to modify Pfeifer '993/Frye to include TiN as the electrode material such as taught by Desu in order to provide a known electrode material, in the form of a conductive nitride, on the surface of a substrate for use in a surface acoustic wave device.

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejections of claims 1-7, 9, 15, 16, 19, 21 and 23 applies equally against the rejection of claim 13 based on Pfeifer'993 in view of Frye and further in view of Desu as claim 13 is a dependent claim.

As submitted above, Martin in view of Frye and Neuberger does not disclose at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes. Pfeifer'944 in view of Frye and further in view of Desu does not provide this disclosure either and therefore fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claim 13 is not disclosed.

Furthermore, as submitted above, the Applicant notes that the Examiner has not provided an explicit rationale as to why it would have been obvious to one of ordinary skill to combine the Pfeifer'993, Frye and Desu references. Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. rejection of claim 13 be withdrawn.

Pfeifer (944) in view of Frye/Ueda

The Examiner rejected claims 14 and 22 under 35 U.S.C. §103(a) as being unpatentable over Pfeifer'944 in view of Frye as applied to claims 1-7, 9, 15, 16, 18, 21, and 23 and in further view of Ueda.

The Examiner admitted that Pfeifer '944/Frye do not specifically disclose that the sensing components comprise electrode materials chosen from among NiCr and CuAl.

The Examiner stated that Ueda has been discussed above. The Examiner argued that it would have been obvious to modify Pfeifer '944/Frye to include an AlCu alloy material for the interdigital electrode such as taught by Ueda in order to provide Pfeifer '944/Frye with a known electrode material for a SAW device (for both surface and leaky surface acoustic waves).

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejections of claims 1-7, 9, 15, 16, 19, 21 and 23 applies equally against the rejections of dependent claims 14 and 22 based on Pfeifer'944 in view of Frye and further in view of Ueda.

As submitted above, Martin in view of Frye and Neuberger does not disclose at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes. Pfeifer'944 in view of Frye and further in view of Ueda does not provide this disclosure either and therefore Pfeifer'944 in view of Frye and further in view of Ueda fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claims 14 and 22 is not disclosed.

Furthermore, as submitted above, the Applicant notes that the Examiner has not provided an explicit rationale as to why it would have been obvious to one of ordinary skill to combine the Pfeifer'944, Frye, and Ueda references. Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claims 14 and 22 be withdrawn.

Pfeifer (993) in view of Frye/Ueda

The Examiner rejected claims 14 and 22 under 35 U.S.C. §103(a) as being unpatentable over Pfeifer '993 in view of Frye as applied to claims 1-7, 9, 15, 16, 18, 19, 21, and 23 and in further view of Ueda.

The Examiner admitted that Pfeifer '993/Frye do not specifically disclose that the sensing components comprise electrode materials chosen from among NiCr and CuAl.

The Examiner stated that Ueda has been discussed above. The Examiner argued that it would have been obvious to modify Pfeifer '993/Frye to include an AlCu allow material for the interdigital electrode such as taught by Ueda in order to provide Pfeifer '993/Frye with a known electrode material for a SAW device (for both surface and leaky surface acoustic waves).

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejections of claims 1-7, 9, 15, 16, 19, 21 and 23 applies equally against the rejections of dependent claims 14 and 22 based on Pfeifer'993 in view of Frye and further in view of Ueda.

As submitted above, Martin in view of Frye and Neuberger does not disclose at least one mode frequency output of the multiple mode frequency outputs is utilized for desorption of at least one analyte of a plurality of analytes. Pfeifer'993 in view of Frye and further in view of Ueda does not provide this disclosure either and therefore Pfeifer'993 in view of Frye and further in view of Ueda fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claims 14 and 22 is not disclosed.

Furthermore, as submitted above, the Applicant notes that the Examiner has not provided an explicit rationale as to why it would have been obvious to one of ordinary skill to combine the Pfeifer'944, Frye, and Ueda references. Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claims 14 and 22 be withdrawn.

III. Additional Claim Amendments

The Applicant notes that claims 3, 13, 14, 18, 21, 22 and 23 have been amended to correct typographical errors and errors of antecedent basis in the claims.

IV. Conclusion

In view of the foregoing discussion, the Applicant has responded to each and every rejection of the Official Action. The Applicant has clarified the structural distinctions of the present invention. Applicant respectfully requests the withdrawal of the rejections under 35 U.S.C. §102, 35 U.S.C. §103 and 35 U.S.C. §112 based on the preceding remarks. Reconsideration and allowance of Applicant's application is also respectfully solicited.

Should there be any outstanding matters that need to be resolved, the Examiner is respectfully requested to contact the undersigned representative to conduct an interview in an effort to expedite prosecution in connection with the present application.

Respectfully submitted,

Dated: June 20, 2008

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